Building Services News

Volume 1 | Issue 2 Article 1

5-1-1961

The Irish Plumber and Heating Contractor, May 1961 (complete issue)

THE IRISH PLUMBER & HEATING CONTRACTOR

Part of approximately 100,000 feet of ¾" bore panel heating tubes installed in the Boeing 707 hangar at Dublin Airport. Main contractors: John Paul & Co. Ltd. Heating contractors: J. J. Nolan & Son Ltd. Mechanical consultant: L. C. Leonard, A.M.I.H.V.E.

An Irish International Airlines' Boeing Shamrock Jet in the new hangar.

VOLUME 1. NUMBER 2.

MAY, 1961.

SINGLE STACK PLUMBING—PAGE SIX

Mrs. 1970 has hundreds of different addresses . . .

Mrs. 1970 lives in hundreds of different houses all over Ireland—because Mrs. 1970 is a go-ahead modern woman who has already had oil-fired central heating installed in her home. And Mrs. 1970 is a woman that women look up to — the leader of fashion, the housewife the neighbours try to keep up with. That's why every week that goes by, more and more houseproud housewives are having oil-fired central hea ing installed with the help of the Irish Shell Housewarming Plan. There is an exceptionally heavy national advertising campaign behind the Irish Shell Housewarming scheme and every advertisement features the Irish Shell Appointed Installer sign, the sign that has already become synonymous with the ease, the cleanliness and the comfort that only oil-fired central heating can bring.

IRISH SHELL 'HOUSEWARMING'

the original scheme for oil-fired central heating in the home

IRISH SHELL LIMITED
IRISH SHELL HOUSE
FLEET STREET, DUBLIN 1

https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q

THE IRISH PLUMBER & HEATING CONTRACTOR

Vol. 1. No. 2.

The new publication in Ireland for the craftsman plumber and contractor, the heating and ventilation engineer and contractor, the electrical contractor, supplier, manufacturer and wholesaler of fittings and equipment for the trades.

●

Published monthly by Irish Trade & Technical Publications. Annual subscription, 15/-, post free. Single copies, 1/6, post free.

●

Editorial and advertising offices:
Callaghan Chambers, 13/15 Dame Street, Dublin, 2. Tel.: 56466.

MAY, 1961.

IN THIS ISSUE

INDEX TO ADVERTISERS

https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q

Now a scientific basis for our ideas

the result of preliminary trials of one-pipe plumbing for low-cost housing in Coventry, Birmingham and London.

This again caused much interest and in 1946 the Building Research Station sent an expert to the U.S.A. and Canada to study plumbing and related research work. As a result of this visit, in 1948 was published the National Building Study Special Report No. 12, "Plumbing In America."

Already, in the previous year 1947, "Post War Building Study No. 26" on Domestic Drainage had been published, so that there was now some scientific basis for our ideas and no longer had the industry to depend on rule-of-thumb methods. Since then other Digests and Reports have been published on this subject, notably B.R.S. Digests Nos. 48 and 49, describing the main causes of seal loss in traps, and the design principles to follow when installing plumbing for two-storey dwellings.

Simplified

THE main basis of all this investigation was to see if plumbing systems could be still further simplified by reducing the number of pipes without impairing the efficiency of the installation.

To do this, a new system called "Single Stack" was set up experimentally. This unit consisted of one 4-inch main stack pipe, 60ft. high, into which all soil and waste connections were made, vent or anti-syphon pipes being omitted.

This structure was then subjected to many tests involving discharge of liquid from various levels, strict observation being carried out to see what effect this would have on the trap seals. The branch pipe falls were also altered many times and the effect analysed.

The final result was the proof that we were fitting vents in many cases where there was no necessity for them. This does not mean that we can dispense with vent pipes from now on, but only under certain defined conditions where this system is installed, and where fitments are closely grouped. It will be seen, therefore, why this system is chiefly applied to municipal housing projects.

In order to ensure that the results would be accurate under normal service conditions, the work was continued in new multi-storey projects for the London County Council. Seven stacks altogether were used in four, five, and six-storey flats, each stack being of 4-inch cast iron, with copper waste pipes and copper or brass traps with 3-inch seals. The appliances were grouped so as to prevent self-siphonage by the water leaving the fitting and carrying the seal with it, and on each floor there was installed a W.C., basin, bath, and sink.

The result of these tests made it clear that up to five storeys high, the single stack system is satisfactory. On higher buildings, up to fifteen storeys, a modified form of this system with a reduced number of vents can be used.

Economical

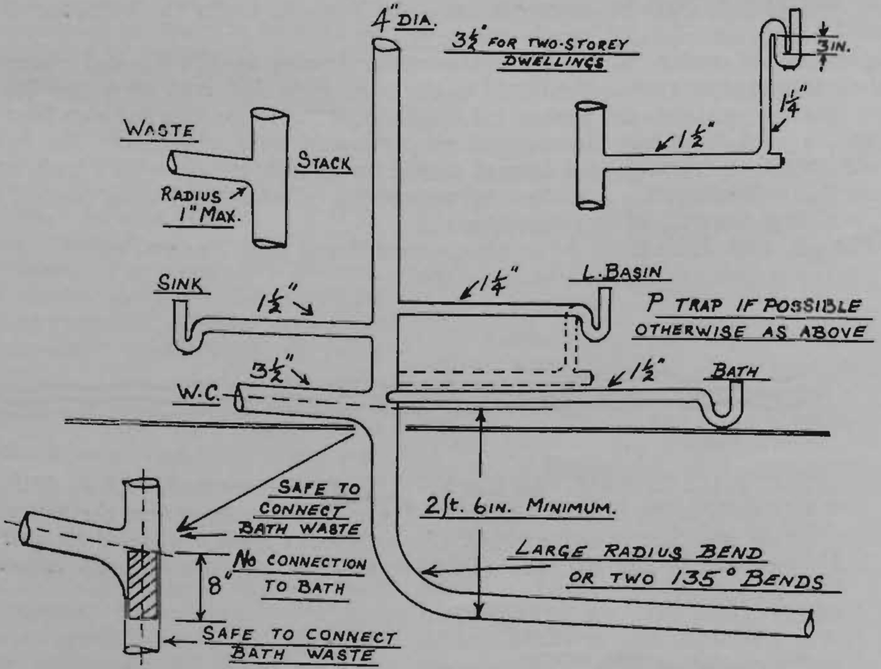
THIS information has been published in detail in the Building Research Station Digest No. 127.

Single-stack systems have now been installed in many housing projects in Britain, and have proved very economical for low-cost flat developments where it was possible to group all appliances within a radius of about 6ft. or so from the main stack. Dublin Corporation has installed this system in their Gardiner Street Flats Project, where it occasioned much interest with architects and plumbing contractors.

The main points to be noted when installing a single stack plumbing system are:—

1. The main stack must have a

continued page Twenty-two.



[A typical example of Single Stack Plumbing design prepared by the author.]

Building Services News, Vol. 1, Iss. 2 [1961], Art. 1

water

Properties of water, specific gravity, water pressure, rules and conversions, and measurement of water pressure.

MILLIONS of years ago, when the earth was a white-hot mass hurtling through space, its hydrogen and oxygen gas content burned together. The result of this combustion was a new substance—water vapour or steam.

On a much smaller scale, water can be manufactured in a laboratory by burning hydrogen in oxygen in the proportions of two volumes to one, as indicated by the chemical symbol for pure water, H2O.

Water has weight, but this varies according to its temperature. The fact is important in the design and installation of hot water systems. Moreover, it affects the placing of taps, for the weight of water, combined with its height above the tap, controls the rate of flow. For normal everyday purposes, and for simple calculations of forces and pressures acting in water which is stationary in pipes and storage vessels, the weight of water is taken to be 62.5lbs. per cubic foot. The following points are also worth noting:

(1) There are 6.25 gals in 1 cubic foot.

(2) One gal. weighs 10lb.

Pure fresh water is tasteless and without smell. At atmospheric pressure and between 32° and 212° F. it is a transparent and almost colourless liquid.

(3) The maximum density temperature of water is 39.2° F. Most materials expand as their temperature rises, and water expands when heated above this temperature. It is unusual, however, in that it also e x p a n d s when cooled below this temperature. It will therefore be seen that above the "waistline" of its maximum density temperature it expands by 1/25th or 4%, and that nearly ¾ of this expansion takes place between 112° F. and 212° F. Below the 39.2° F. "waistline", water expands as its temperature falls. Note carefully that an equal volume of water weighs less at 32° F. than at 39.2° F., since this provides proof that expansion has taken place.

(4) Pure water boils at 212° F. at standard atmospheric pressure (30 ins. of mercury) and changes from the liquid

See pages Twenty-six and Twenty-seven for illustrations

to the gaseous state, expanding some 1.700 times as it does so, consequently it is convenient and sufficiently accurate to say that the expansion is 1.728 times the original volume of water. As there are 1,728 cubic inches to 1 cubic foot, it can be said that one cubic inch of water will produce one cubic foot of steam.

Hot water cylinders

EQUALLY, one cubic foot of steam at 212° F., when condensed to water at the same temperature, produces one cubic inch of water. This fact will be used later in the series to explain in part why hot water storage cylinders sometimes collapse inwards under the influence of atmospheric pressure.

(5) Pure water freezes at 32° F., and changes from the liquid to the solid state (ice) with an immediate expansion of 1/10th. Thus, if the water in a ten-inch tube were to freeze and all expansion were lengthways, the column of ice formed would be 11 inches long, with 1 inch, or 1/10th of the original volume of water projecting beyond the end of the tube.

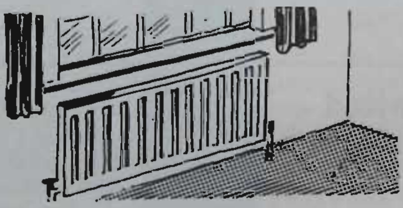
continued page Twenty-three

FACULTY OF PLUMBING . . . A. L. Townsend, M.R.P., M.R.S.H., a Lecturer at the Oxford College of Technology continues here the first part of a four stage course in plumbing. The author has closely followed his own lecture programme and has paid particular attention to scientific and technological innovations.

DOI: 10.21427/D7CM5Q

automatic temperature control - - - - 2

SPACE HEATING CONTROLS



By
R. E. AYERS,
M.A.S.E.E.

THE object of a space heating installation is quite simple—it must maintain comfort conditions within the space irrespective of changes in external conditions. That it can attain this object with the minimum consumption of fuel is the major function of an automatic temperature control scheme.

The factors which must influence the choice of the correct control scheme are many—and to assist the heating engineer in determining the best scheme most reputable manufacturers of controls offer a specialist sales organisation. It is strongly recommended that they be used wherever possible. It will be readily seen that the control scheme for each heating installation must be chosen on the factors involved in that particular installation, and for that reason it would be impracticable to cover this subject in the space of one short article. Since the most common installation met with is that of heating by low pressure, hot water or steam, it is intended to cover the controls for those forms of heating in this article. At a later date it is hoped that controls for air warming and air conditioning systems can be reviewed.

Every space heating installation commences with a source of heat production. It may be an L.P.H.W. boiler, steam boiler or calorifier, but it is necessary to ensure that the control system produces the necessary heat as required. In most cases there is an added requirement of safety control.

Heat Source Control.—In a L.P.H.W. boiler the primary firing device is controlled from water temperature by means of an immersion thermostat. On smaller systems it is possible to vary the water temperature, leaving the boiler or even control the boiler direct from a space thermostat. In any installation it is always good practice to provide a limit thermostat in series with the control thermostat as a safety device. On larger installations it is becoming more common practice to run the boiler at a constant temperature and control the space temperature external to the boiler. Where high temperature water is required for other purposes, such as domestic hot water, then the above type of control becomes necessary.

Steam boilers are controlled by pressure switches, again a limit pressure switch being good practice. In addition protection against low water conditions must be provided.

Calorifiers are of two types. The storage calorifier because of its storage capacity, can be very easily controlled by an on/off valve and immersion thermostat. The non-storage type of calorifier, usually steam/water, with a small water capacity, requires a more sensitive control and lends itself to the proportional or floating controller. This can be arranged to produce a constant outflow temperature or it can be compensated to give a varying flow temperature in accordance with outside conditions. This method is explained later.

No mention has been made of the controls fitted direct to the primary firing device but since these are normally safety controls and form no part of the space heating control scheme, they are not dealt with in this article.

Having produced our heat there are many ways in which it can be dissipated to the space which is being heated. Radiators, convectors, unit heaters—these are only a few of the devices available and each one produces another factor to be taken into account when determining the control scheme. There are two main types of control available—those which operate direct from space temperature and those which anticipate alteration in heat losses and alter the input of heat accordingly.

Space Temperature Controls.—Since the close control of the space temperature is our main objective, it would seem logical to use that temperature as a control point. This can be done by:—

(1) Using a space thermostat to control the boiler direct. This can be done on small installations provided the boiler is not used to provide a source of heat for other purposes. The differential in temperature obtained by such a control scheme would be large.

(2) Using a space thermostat to control an on/off valve, Fig. 1, on the heating flow to the space being controlled. This system is in common use where small spaces are involved and gives some degree of adjustment for individual tastes. However, where large buildings are concerned a control system of this type would require many control units, i.e., a valve and room thermostat and this is not always practical. Again it is sometimes very dfficult to choose a position for the thermostat which will provide a good control characteristic and yet suit the user's preference—in a multi-office installation controlled by this method the whole installation would be subject to the tastes

See page Twenty-one for continuation and illustrations

https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q

The second article in a short introductory series

by **JAMES M. HAIG**, A.M.I.W., A.M.I.P.

SMALL BORE HEATING

HAVING dealt last month with the room temperatures, the heat requirements can now be calculated, starting off by taking the difference between outside and decided inside temperatures to give the temperature difference rise, the outside temperature always being taken as 30°F.

The heat loss through the floors, walls, windows, ceilings, etc., is now dealt with. The amount of heat lost through these surfaces, that is in B.Th.U/per square foot/per degree F. is known as the transmittance coefficient or the 'U' value of the material. The heat lost through each wall of every room should be dealt with separately, including partition walls and intermediate floors between rooms. Generally, in the case of adjacent rooms, the difference between their design temperatures is taken, but if there is no heating in one of the rooms, an assumed average temperature of 55°F. for living-rooms and 50°F. for bedrooms should be used for calculating the temperature difference.

The amount of heat lost by ventillation is now calculated by multiplying the cubic capacity of the room by the number of air changes per hour × the temperature difference × 0.02 B.Th.U. which is the amount of heat necessary to raise one cubic foot of air through 1°F. In existing premises, unless precautions are taken, air changes very much greater than this may occur; particularly does this apply to rooms with large open fireplaces, which will withdraw air at a rate at least three times that necessary for normal ventilation purposes. Indeed, it is not uncommon for 12,000 cubic feet per house to be withdrawn via an open fire, even when it is burning at a low rate, should a small window be left open. In such cases the amount of air removed could send up the chimney over 5,000 B.Th.U. per hour and this would represent a large proportion of the heat emitted from the room radiator. This is the reason why in many houses having heating systems the room temperatures drop by several degrees when an open fire is lit; where such fireplaces are already installed, it may be necessary to introduce some form of damper within the flue to restrict the air movement to the rates required for comfort.

In the case of the 'open plan' type of house, one which is becoming increasingly popular in these days, difficulty is being experienced in heating economically, it generally being necessary in this instance to assume a room temperature of 70°F. and to maintain this for calculation purposes throughout the whole house.

Having completed the calculations for each room as defined above they are added together to give the total heat required for the whole building.

The next step is to plan the radiator positions and pipe runs. This is a matter that requires some care. Wherever possible, radiators should be sited under windows. The advantages gained thereby are as follows:

They make use of all areas not normally occupied.

They avoid the soiling of decorations by dust-laden convection currents.

They overcome down-draught.

They provide better temperature distribution through the room.

In some cases, particularly in already existing premises, built-in furniture may make siting of radiators under a window impossible, and they may have to be mounted on or against a full wall. Under these conditions, one should always fit a canopy across the full length of the radiator top to prevent staining of the walls and ceilings by dust-laden convection currents.

In preparing a plan of the pipe runs, it should always be borne in mind that the shorter the pipe circuit the better. The plan itself should be drawn to a sufficiently large scale for all pipe runs, with the positions of valves, etc., clearly indicated. Later as each pipe circuit is sized, the pipe diameter should be marked on the drawing. If an isometric projection is drawn, quantities may be read off from it.

With the pipe circuit, radiators and valves marked on the drawing, the next step is to calculate the friction losses through the pipe runs, to ensure that they come within the pressure head range of the available and suitable types of pumps. It is here that the choice of copper tube, as the most suitable material to use, becomes a major factor. The smooth internal surface, allied to a slightly larger bore than the equivalent ⅜ in. nominal black iron tube, gives a much lower friction factor. The tests carried out by the British Coal Utilization Research Association showed that for a given rate of circulation the pressure drop per foot run of pipe is approximately 40 per cent. less for copper. Further, as the manufacturing tolerances for copper tubes are much less than is the case with iron pipes, greater accuracy is obtained in calculating friction losses. Added to this, the copper tube has a slightly smaller outside diameter, making for neater appearance.

To arrive at the friction losses in

continued page Sixteen

A CONTRACTOR report from the Mansion House, Dublin, on the recent

TURN OF THE TAP EXHIBITION

***"A few years ago it was only a pipe dream, now it can become a piped reality"*—Neil T. Blaney, Minister for Local Government.**

A **FEW** years ago it was only a pipe dream and now it can become a piped reality!

That, briefly, is the driving force behind Ireland's latest and most progressive National project, which aims at a piped water supply for every home in the country. It is a streamlined, £35 million, ten-year plan which has aroused enormous support and backing.

The spotlight was beamed on the project in Dublin's Mansion House last month, when the 'Turn of the Tap" exhibition took place. And during the exhibition, a one-day conference entitled "Rural Water Supplies," was held. Thousands attended from all parts of Ireland, among them many represenetatives of the 250,000 householders for whom it is hoped the campaign will achieve piped water supplies at the earliest possible date and in the most practical and economic fashion.

Admirably expressed

Optimism was the keynote of the conference. And this optimism was admirably expressed by the guest speaker, Mr. Neal T. Blaney, Minister for Local Government, when he told the gathering:—

"Public opinion is awakening to the need for this major step forward in raising living standards in the countryside. Our people are becoming water conscious, and none too soon. Even now only fifteen per cent. of dwellings—one out of every seven —have piped water. Approximately a quarter of a million rural houses lack this vital service. In a predominantly rural country such a state of affairs must constitute a reproach as long as it is allowed to continue."

Conference listened attentively as the Minister declared that progress on the campaign had been encouraging. Reviewing progress up to March 31 last, the Minister said the position was most encouraging. Compared with a year ago, the aggregate value of water supply and sewerage schemes had increased by £3.7 million and was now approaching the £11 million mark. The bulk of the increase was reflected in a £2¼ million increase in schemes at the contract document stage, and that augured well for an early and substantial improvement in the quantity and value of work actually in progress.

"Some opposition"

He then dealt with what he described as "some opposition" to the direct participation of County Councils in the rural water supplies drive to the extent which would be necessary if a good job was to be done. A great deal of that opposition, he said, came, perhaps, from people who already enjoyed piped water, provided either by County Councils or by themselves with the aid of substantial grants from the taxpayer and ratepayer.

"I have no statutory power to dictate or control levels of water rates," said the Minister, "but I would regard it as most undesirable and retrograde if the principle of community cost-shearing were thrown overboard in relation to such an important service as water supplies and replaced by the principle of 'I'm alright, Jack.' High water rates would discourage connections and create difficulties both for Councils and potential consumers."

Dealing with private water supply grants, the Minister said he had tried to secure a progressive development of the role of private enterprise in the campaign for the extension of piped water supplies.

The Government, he said, had decided that a single scheme of grants, on the general lines of that operated by his Department, should replace the existing Local Government and Agriculture schemes. The special scheme operated by Roinn na Gaeltachta would not be brought within the ambit of the unified system but would continue on a separate footing.

Representations, he said, had been made to him from time to time on a number of aspects of group scheme movement. A matter of immediate concern was the request for payments of water supply grants. He had decided to grant this request and he was also glad to announce that it was intended in future to pay private water supply grants to occupiers of unvested council cottages who participated in a private group scheme or decided themselves to install a private water supply.

Group schemes

He had also been examining the question of the taking over of group schemes by County Councils. Opinion among group participants had been generally against this take-over for the understandable reason that those people who had put their own time and money into the schemes would then be faced with paying a water rate.

He listed the main constituents of the "eventual solution" to the rural water supplies problem as: (1) the County Councils; (2) co-operative groups, and (3) family individuals installing their own private supplies.

In this connection he wished to emphasise that there were not three independent areas of activity working against each other. Each type of

https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q

● Pictured at the Mansion House (left to right): Charles Curran, Chairman Waterford Co. Council; John Fahey, M.C., Chairman Waterford County Committee of Agriculture; J. G. Dowling, A.C.A., Secretary Waterford, Co. Council; T. J. Byrne, B.E., County Engineer, Wicklow, Co. Council; E. J. Keyes, Staff Officer, Waterford Co. Council; J. D. Hally, B.E., County Engineer, Waterford, Co. Council; N. Walsh, Vice-Chairman, Waterford, Co. Council; Maurice O'Connell, B.E., County Engineer, Donegal Co. Council; J. B. Barry, B.E., Consulting Engineer; J. E. Merry, B.E., County Engineer, Clare, Co. Council.

activity might occupy a sector of the front but the organisations and individuals concerned were part of a single force working towards a single objective: piped water in the maximum number of rural houses and farms with the minimum of delay. He rejected the suggestion that his Department and the County Councils were committed to large-scale regional supplies and that they were, by implication, opposed to other types of development.

Presiding at the conference was Mr. P. J. Meghen, Limerick County Manager, a Vice-President of Muintir na Tire, and a pioneer worker in the rural water campaign.

Major problem

Piped water supplies for the rural areas, he said, was a major National problem requiring solution. The address they had heard from the Minister would give them hope and confidence and enable them to move forward.

The woman's point of view was put forward by Miss Kathleen Donnelly, of Inch, Organiser of the Irish Countrywomen's Association, who arranged the "Turn of the Tap" exhibition in conjunction with the "Farmers' Journal."

Mr. J. Barry, a consulting engineer from South Tipperary, said it was heartening to realise that the principle of a piped water supply for every household in the country seemed to have been accepted. There was a fair amount of argument and discussion about the best solution to the piped water problem. It would be a pity if even one household was deprived of water because of those arguments. None of the three methods of tackling the problem offered a complete solution, and the problem would only be solved by a combination of those methods.

Local authorities had considered all the problems, he said, and he advised rural organisations to consult their County Council before embarking on water schemes. In that way their particular projects could be made to fit in with plans for the rest of the area.

Sizeable portion

Rev. J. C. Collins, C.C., Manor Kilbride, a member of the Joint Committee of the Rural Water Campaign, said the people of North West Wicklow had co-operatively installed water in their homes. By the end of this year they hoped to have piped water in the houses of quite a sizeable portion of the area.

Dr. L. Smith, Economic Adviser of the National Farmers' Association, said the economist had a right to ask what the financial return of a scheme for piped water in rural areas would be. Since the scheme was to be a social service, the cost should be levied from the community as a whole and not from a particular area.

The farmers' point of view was given by Mr. J. Richardson, of Galbally, Co. Limerick, who said that from personal experience he could not speak too highly about the need for piped water. If the bovine T.B. eradication scheme was to be completely successful, piped water was a "must."

Some aspects

Referring to some aspects of water supply development in Northern Ireland, Mr. Dermot Hughes, B.E., A.M.I.C.E., Northern Ireland representative of Messrs. Nicholas O'Dwyer, Son and Partners, said the total expenditure on water schemes in Northern Ireland under the 1945 Water Supplies and Sewage Act was £20 million approximately up to the end of 1960.

As a result of the passing of that Act the formation of joint water boards was considerably accelerated and there were now ten of them in existence which would, on full development of demand, eventually serve a combined rural and urban population of approximately 550,000.

He thought the basic problem concerning water supplies in Ireland was an economic one, as generally speaking our resources of water were much more than adequate for the requirements of the population. In Northern Ireland the economic yardstick was the cost of providing piped water to each house situated in the rural localities. The maximum allowed was £250 per house, and that had been increased in recent times to £300.

The attendance included Mrs. Kit Ahern, National President, I.C.A., and Mrs. Aine Barrington, Chairman, Joint Committee, Rural Water Campaign.

Westmeath County Ccl. seek tenders

Westmeath County Council has requested Tenders for the Installation of Hot and Cold Water Services in Sanitary Annexes at St. Mary's Hospital, Mullingar, in accordance with the drawings and specification prepared by and under the supervision of J. C. Costello, M.Sc., M.E., A.M.I.E.E., M.I.C.E.I., Consultant Engineer,, of 21 Leeson Park, Dublin.

Copies of the Tender Documents may be obtained from the Consultant Engineer.

The drawings and specification may be inspected at the office of the Architect, Wilfrid Cantwell, B.Arch., F.R.I.A.I., F.R.I.B.A., 13 Fitzwilliam Place, Dublin, or at the office of the Consultant Engineer or at the office of the Matron on the site.

Tenders, in sealed envelopes, on the standard form provided are to be lodged with the Secretary, Westmeath County Council, County Buildings, Mullingar, not later than 1 p.m. on Saturday, 27th May, 1961.

https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q

A 'Contractor' Report On The *E.S.B. WARM HOME PLAN*

THE obvious advantages of the E.S.B. plan lie in its ease of installation, the low capital cost and, in the fact that it eliminates the necessity for the storage of fuel and operates automatically.

Approved electrical contractors have shown their enthusiasm about the electric Warm Home Plan in the sponsoring of a considerable amount of national advertising in connection with the scheme. Under an arrangement between the Electricity Supply Board and the electrical contractors members of the public who arranged to have the scheme installed by an approved contractor may have the repayments—which can be spread over a period of five years—put on their E.S.B. account, just as if the installation was purchased directly from the E.S.B.—a factor which has improved the selling position of the electrical contractor tremendously.

Basically the electric Warm Home Plan is a simple one. It has been designed to suit either new buildings under construction or existing houses of practically any type.

In the case of buildings under construction, it is recommended that electric floor warming be used in the hall and living rooms and that in bedrooms either thermostatically controlled convector or tubular heaters or infra-red heaters be employed. Infra-red heaters are recommended in all cases for use in bathrooms.

In the case of existing houses, thermostatically controlled storage heaters are recommended for use in the hall and living rooms and appliances similar to those for new houses for the remainder of the house.

One of the most important factors affecting the efficiency of the night storage heaters, or floor warming, is the fact that the Board has now introduced the option of a two-hour afternoon "boost" which ensures that comfort conditions are maintained over the entire period.

A frequent problem was the case of the storage heater or floor warming system on the night storage rate, which might have cooled off in the evening when their services were required in domestic premises. Now, with the boost it has been found that there is no problem whatever in maintaining adequate temperatures throughout the day.

On the side of economics, the electric Warm Home Plan brings a whole house heating system within the reach of many who would not have previously considered central heating. With capital costs ranging from £102, in the case of a semi-detached three-bedroomed two-storied house of 1,000 square feet floor area, and repayments as little as £4 every two months, it obviously becomes an attractive proposition for the lower and middle income groups.

Many people have also been reluctant to install central heating because of the problems of fuel storage and stoking and the elimination of these factors certainly makes an overall heating plan more acceptable to the general public.

The E.S.B. provides an excellent service in the installation of the Warm Home Plan in conjunction with the electrical contractors. When a prospective customer is in touch either with the Board or with the contractor, and when his needs have been ascertained, the actual heating plan—which is designed from a questionnaire—is completed by a qualified heating engineer and a quotation is prepared. This system ensures that in all cases an efficient design is available to the customer whether he buys from a contractor or from the E.S.B.

Electricity Boards in England have shown a tremendous interest in the "plan" pioneered by the E.S.B. and it is not unlikely that in the near future a similar plan may be launched in Great Britain.

● The new "Mechavent 75" MK.II fan unit and companion canopy.

A FRESHER fume-free kitchen say the manufacturers (and that's as good a selling point as any) of the new Greenwood Airvac "Mechavent 75" Mk. II.—a compact and easy-to-fit electric kitchen fan.

Wall mounted above the cooking stove the "Mechavent" gives kitchen freshness by extracting fumes, steam and cooking odours at their source.

The "Mechavent" fan unit has these special features:—

Automatic fan control by opening or closing shutters;

Adjustable shutters to prevent back-draught;

Plastic fan impeller for quiet, trouble-free operation;

Internal full flow safety grille;

Fully weathered aluminium external grille; and

Speed regulator where required.

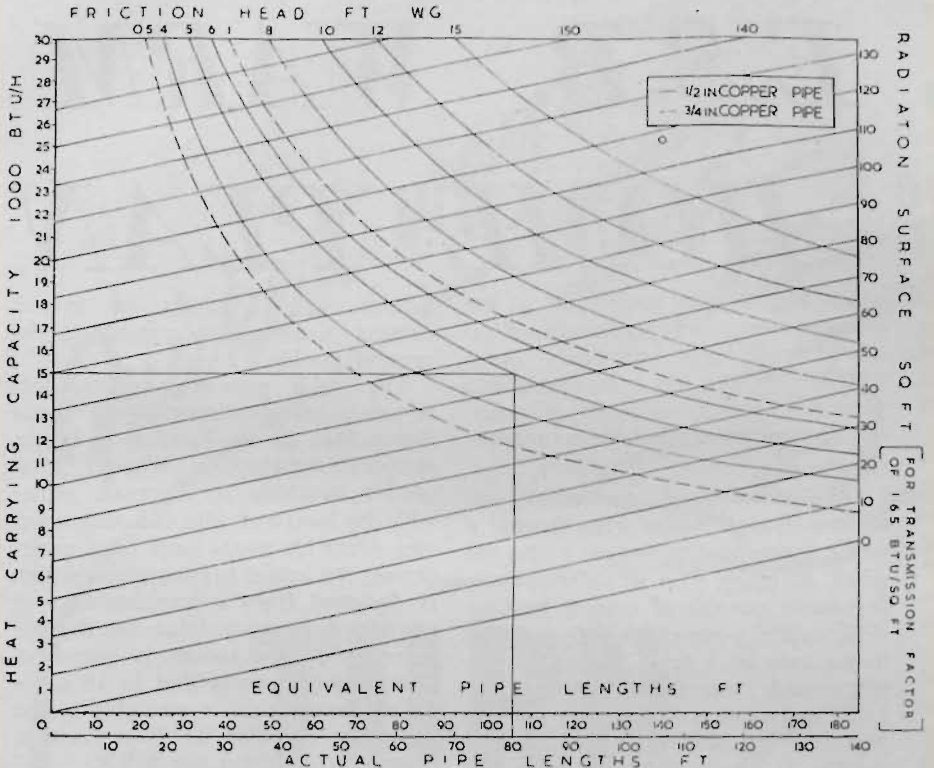
The fan's capacity is 13,800 cubic feet per hour and it will change the air in an average kitchen more than 14 times an hour, using less power than a normal electric light bulb.

The fan and motor are self-contained and fit neatly into a 9½-inch square opening in the wall.

Specifically designed to fit over standard domestic cookers, the new Greenwood Airwac "Mechavent" Kitchen Canopy in fibreglass increases the efficiency of kitchen ventilation.

The "Mechavent" canopy is manufactured of reinforced fibreglass and measures 25" x 25" x 12" overall. It weighs 4lb. 12ozs. and is supplied in attractive high glazed white, pale cream and signal red colours.

The Technical Sales Company, 79 Lower Leeson Street, Dublin, are Irish agents for these new products. Prices: "Mechavent 75" MK.II fan unit, £15 list; and the companion canopy, £9 list.



from page Eleven

SMALL BORE HEATING

the pipe circuits, these are each measured separately to give an actual foot length of pipe in each circuit, to which is added an allowance of one-third to cover the frictional resistance of fittings and valves, etc. While this may seem an arbitrary method to adopt it is indeed one that has been found to give very satisfactory results.

Heat emission

THE FULL heating load for each main circuit must now be ascertained by taking the heat requirements of the rooms served by the circuit and adding the heat emission from the circuit piping where it passes through other parts of the building. With the flow and return running at 180°F. and 160°F. respectively, this allowance is taken at 55 B.Th.U./h per foot run of pipe for $\frac{1}{2}$ in. tube and 70 B.Th.U./h for $\frac{3}{4}$ in. tube. Where unpainted copper tubes are used a mean factor of 35 B.Th.U./h per foot run and 45 B.Th.U./h per foot run should be allowed for $\frac{1}{2}$ in. and $\frac{3}{4}$ in. tube respectively. With the total heating load for a circuit known, the friction loss may be read from the graph; at the same time it is advisable to check that it comes within the pumping head available.

As an example, we will assume that a circuit consists of 80 ft. of $\frac{1}{2}$ in. copper tube carrying a full heating requirement of 15,000 B.Th.U./h. The graph shows a friction loss of 4 to 5 ft. W.G., well within the available pumping heat. It will be noted that for convenience the graph gives the actual circuit length along the bottom line; and just above it, the equivalent pipe length covering the combined circuit pipe length and the one-third allowance for frictional resistance.

In the event of the frictional resistance of a circuit being greater than the available circulating head, the circuit must be re-designed to give a smaller total length if possible; or alternatively, the designer can regroup the radiators to give an additional circuit, thus spreading the heating load. In certain cases, particularly in large houses, it may be necessary to increase the pipe size to $\frac{3}{4}$ in. for part of the main circuit. Under such circumstances, it is necessary to calculate the heat emission of the $\frac{3}{4}$ in. tube at the rate of 70 B.Th.U./h per foot run.

An alternative method, using larger pipes, is to design the system for a temperature difference between flow and return of 30°F. at the boiler, as against the previously quoted and normal figure of 20°F. differential. The effect of this is to lessen the frictional resistance in the main circuit by lowering the rate of water circulation. It must be pointed out that if such a course is adopted, larger radiators with $\frac{3}{4}$ in. connections may be necessary to compensate for the lower heat emission.

Where two or more circuits share common flow and return mains, the heating loads of the circuits served must be calculated and used to obtain the resistance of the common mains from the graph. Equally, the heating load of the common mains, by emission and any radiators they feed, must be divided proportionately between the circuits they serve.

Radiator circuits

The short connecting mains between the various radiator circuits and boiler are usually $\frac{3}{4}$ in. tubes, except where there are four or more separate radiator circuits; in these instances, a 1 in. diameter tube should be used.

Finally, it is necessary to calculate the radiator surface area that each

continued opposite page

https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q

● *Pictured at the Conference were (l. to r.): Mr. T. W. Bamford, Director/Manager, Universal Fabricators Limited; Mr. W. Dressler, Chief Engineer, A. Guinness Son & Co. (Dublin) Limited; Mr. S. Warnock Aitken, General Manager, Industrial Gases (I.F.S.) Limited; Mr. W. Cronin, Generation Dept., E.S.B.; Mr. Stephen McGloughlin, Joint Managing Director, J. & C. McGloughlin Limited, and Mr. B. G. Cantwell, Technical Assistant to the General Manager, Unidare Limited.*

New Irish Welding Association President

THE annual meeting of the Irish Welding Association was held during the course of the two-day regional conference of the British Welding Research Association, held in the College of Technology, Dublin, last month.

Mr. William Dressler, Chief Engineer of Messrs. Arthur Guinness, Son and Co., was elected President.

The outgoing President, Mr. Stephen McGloughlin, said that 1960 was another year during which progress had been made, but he had to say that it had been made with disappointing slowness. Their most significant achievement had been agreement on the standard tests which it was proposed to adopt for welding operators, in line with international practice.

During the year also, the Association, with the usual valuable assistance of Mr. J. D. Barry, had arranged lectures on the economics of welding in Carlow, Cork, Waterford and Limerick.

Officers Elected

Mr. William Cronin. B.E. (Electricity Supply Board), was elected Honorary Secretary in succession to Mr. J. C. Costello, M.E., and Mr. S. Warnock Aitken (Industrial Gases, I.F.S., Ltd.), became Honorary Treasurer, in succession to Mr. T. W. Bamford (Universal Fabricators Ltd.).

Other members of the Management Committee representing various categories who were elected were: Mr. S. J. McGloughlin (J. and C. McGloughlin Ltd.); Mr. T. W. Bamford, Mr. B. G. Cantwell (Unidare Ltd.); Mr. J. C. Costello and Mr. J. D. Barry (Vice-Principal, College of Technology).

The Minister for Industry and Commerce, Mr. Lynch, was guest of honour, and Mr. William Dressler, the new President of the Irish Welding Association, was in the chair at the annual dinner of the organisation in the Shelbourne Hotel, Dublin.

FROM PREVIOUS PAGE.

Small bore heating

room requires and to choose the type most suitable for the purpose. To calculate the radiator surface for any room, first take the actual foot run of exposed pipe in that room and multiply this length by the emission factor of 55 B.Th.U./h. This figure is then subtracted from the total heat requirement of the room, which has previously been found. The remainder is divided by the radiator transmission factor for an average temperature difference of 100°F., i.e. between the water in the radiator and the ambient air, to give the total radiator surface required.

With the normal cast iron or steel radiators, an average transmission factor of 165 B.Th.U./h. per square foot may be accepted. Working with this factor and knowing the length of exposed pipe in the room, the required radiator area may be read directly from the graph. For instance, for a room with a heat loss of 8,000 B.Th.U./h. and having 20 ft. run of exposed pipe, the graph gives 40 square feet of radiator surface. Some radiators, such as pressed steel wall radiators (single), cast iron two-column and hospital patterns, have higher transmission rates than the 165 B.Th.U./h. square foot and if the graph is used then the given figure may be reduced by 10 per cent. But if the temperature differential between flow and return mains at the boiler is designed at a figure other than the normal 20°F. the graph must not be used. In such cases, it is best to consult the manaufacturer's catalogue and from the tables given, work out the required radiator surface. The same remarks apply if skirting heating or convectors are being used.

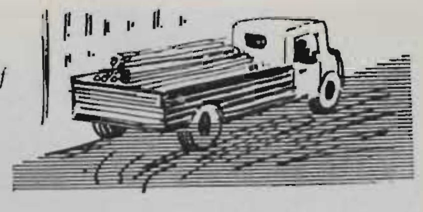
Generally the choice of the particular type of radiator used is a matter for consultation with the householder. Panel wall radiators are very popular if there is enough space available to accommodate the required length. Where space is very limited, the cast iron column radiator, with its higher heat transmission, may have to be fitted despite its somewhat ugly appearance.

DUTY ON PUMPS

The Government has made an order imposing a Customs duty of 50 per cent. (33 1-3 per cent. in the case of the United Kingdom and Canada) ad valorem on certain power-driven pumps for pumping liquid and on certain parts of such pumps.

https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q

Increasingly the plumber uses plastics in his day-to-day work and this series of articles propose to deal thoroughly with their applications to the trade.



PLASTICS AND THE PLUMBER

By
D. C. COYLE,
M.E., M.I.C.E.I.,
M.I.P.H.E., A.M.I.C.E., A.M.I.W.E.

THE plumber of to-day is faced in his day-to-day work with an ever increasing variety of articles, which he is required to fix or deal with in some way or another. In particular, he is being called upon more and more to handle and work with materials quite different to the traditional lead, copper and other metals, which have been the mainstay of his work in the past.

Over the last 15 years particularly he has become aware of an ever increasing use of the word plastic or plastics. Whilst he has grown accustomed to hearing this word used in connection with such articles as toys and household goods—wash basins, table tops and a most of other items—he has personally in his work become aware of an ever increasing use of the word plastics in connection with materials, such as pipe, which he is asked to use in his daily work.

It is, perhaps, fitting therefore that in this first article on "Plastics and the Plumber," we should ask ourselves at the outset, what are plastics or plastics materials?

The term or name plastics began to appear in general use, particularly amongst scientists and in technical literature, in the 1920's. It was used as a name to cover a whole range of new materials, which were then beginning to occupy the minds of scientists and industrialists to an ever increasing extent.

It should be clearly noted that we speak of plastics and plastics materials, for all plastic substances are not in fact plastics.

The term plastic is applied to anything, which processes plasticity, that is, anything which can be deformed under mechanical stress, without losing its cohesion and is able to keep the new form given to it. The important phrase here is "without losing its cohesion." Plastics, which are the materials we are considering, do not flow like liquid—there are a few notable exceptions—but retain the structural characteristics of solids even whilst flowing. To state that plastics are substances which can be made to flow under the influence of heat and pressure is not a sufficient definition. Obviously, such a definition will embrace many materials, such as some metals, and glass, which most certainly cannot be included in the plastics family.

Organic materials

BY contrast with all these materials, plastics have an outstanding characteristic, which is that they are mainly based on carbon and are derived from products characterised by their relationship to the living—that is, the organic class of materials as opposed to the inanimate or inorganic class, which includes glass and metals.

A result of the organic nature of plastics is that consisting mainly of carbon—they cannot withstand great heat. They begin to decompose at temperatures of the order of 200°C. (392°F.), but in most cases cannot be applied at temperatures approaching these figures.

Unfortunately, this whole question of plastics is a complicated one, but I think it will serve our purpose amply if I say, that a plastics material is an organic material which at some stage in its history is capable of flow and is in a plastic condition during which it may be shaped, often with the aid of heat and pressure, and will retain that shape when the heat and pressure are withdrawn.

In short, therefore, when we are dealing with the materials, particularly pipes, which I will refer to in future articles, we must bear in mind that in the plastics industry, the word used is plastics. We speak, therefore, of a plastics pipe, not a plastic pipe, which could be a reference to a metal pipe.

Two main groups

PLASTICS may be divided into two main groups—the Thermosetting materials and the Thermoplastic materials.

Thermosetting materials generally require heat and pressure to mould them into shape. On the first application of heat they become soft and plastic. However, as further heat is applied, the materials undergo a chemical change and set hard. This is known as Thermo-hardening or Thermosetting. Reheating of these materials will not soften them to any appreciable extent and intense heating will cause the breakdown of the material due to burning. The most important material of this nature with which you are familiar is probably Baketlite.

The Thermoplastic materials on the other hand are those which soften on the application of heat and require cooling to make them hard. In the case of these materials no chemical hardening action takes place and so Thermoplastic materials will resoften when they are reheated.

The Thermoplastic materials, which you have probably met most often to date, are PVC, which is a short way of writing the words Polyvinyl Chloride; and Polythene. In so far as the plumbing trade is concerned the Thermoplastics are the most important materials.

In subsequent articles, I will deal in greater detail with PVC and Polythene, which are to-day the two most important materials in the plumbing field.

Building Services News, Vol. 1, Iss. 2 [1961], Art. 1

Hartley & Sugden Ltd.

— WHITE ROSE BOILER WORKS —

Halifax, Yorks.

'Phone: 3238 Halifax. **Established 1867** 'Grams: Boilers, Halifax.

Representative for Republic of Ireland:
McGRATH & KENNY, 48 Townsend Street, Dublin. 'Phone 73108-9.

MAKERS OF BOILERS, CALORIFIERS, STEAM GENERATORS AND ASSOCIATED EQUIPMENT.

"WHITE ROSE" Cast-Iron Sectional for central heating and domestic hot water supply. Capacities, 43,500 BTU—1,640,000 BTU per hour. Suitable for solid, stoker or oil firing. Renowned for Durability, Efficiency and Reliability.

"OILEX" Mild Steel Welded Fire Tube Boiler, specially designed and proportioned for Oil firing. Riveted Vertical Crosstube and **"HALIFAX"** Multitubular Steam Boilers for high steam pressures.

Write to Head Office for illustrated catalogue.

INVITATION . . .

We extend a hearty invitation to our many friends in the plumbing trade and all those interested in modern kitchen and bathroom furniture and fittings to visit our extensive showrooms.

Compression Joint Fittings - Copper Piping - Pipe Wrap - Copper Cylinders - Open Top Tanks - Pressed Steel and Cast Iron Radiators - Oil Fired and Solid Fuel Boilers - Baths, Basins, Toilet Sets, Shower Fittings - Mixer Fittings - Stainless Steel, Enamel Steel, Fire Clay Sinks - Blow Lamps, Solder - Bathroom and Kitchen Furniture - Double Compartment Tanks.
For a full comprehensive supply of plumbing materials:

DOCKRELLS of Georges St., Dublin

TRADE ENQUIRIES INVITED.

https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q

from page nine

Space Heating Controls

of people who occupy the office wherein is fitted the thermostat.

Anticipatory Controls.—These allow an installation to be governed in respect of heat input by control from a medium other than space temperature, usually outside weather conditions. Under such a control system the heat input would be varied as weather changes occur and thus the space temperature of the whole building would be maintained at a constant level irrespective of such changes.

There are a number of these types of controllers available. Some use a direct acting type of transmission to alter the setting of the control valve —these controls use capillary tubing to connect the outside component to the control valve and are subject to some limitations in siting. Moreover, the outside component is sensitive to temperature only and on large buildings heat losses can be greatly increased by wind and rain effects.

Another type is completely electrical in operation and has the advantage that it can be used to control a boiler direct, or the steam valve to a calorifier or a mixing valve in the heating flow. The control consists of three components—an outside detector, a calibration box and an immersion thermostat.

The outside detector is a bellows operated unit, Fig. 2, the bellows being surrounded by a heater which is constantly energised. Thus the detector is sensitive to all the elements which cause heat losses from the building under control, temperature, wind, rain and, to some extent sun— although the best results are obtained from siting the detector on a north or north east wall.

The calibrator box receives the signal from the outside detector and transmits it to the immersion thermostat by altering the control setting of the thermostat. The calibrator box allows adjustment of outside conditions to flow temperature ratio to suit individual installations and also provides facility to reduce flow temperatures for periods when full heat is not required.

Zoning.—In large installations there are factors which make control from a single point difficult. The problem of aspect with its differing heat losses, solar gains on one side of a building, effect of wind on upper storeys—these are but a few of the problems. To offset this it is possible to zone an installation, providing separate heating flows to the various sections of the building and then controlling each section according to the conditions affecting it. One could, for example, use an anticipatory control on each section or a single anticipatory control with a number of on/off valves controlled by local space thermostats.

Same method

ALTHOUGH not strictly zoning the same method can be used where different types of heating devices are installed. For instance a large factory building might use radiators for the office block, forced flow convectors in the stores and unit heaters in the works—all of which require a slightly different control approach.

Specialised Control.—Although it is not possible to cover all types of heating devices in detail, the following notes may be of some use in determining the most suitable control scheme.

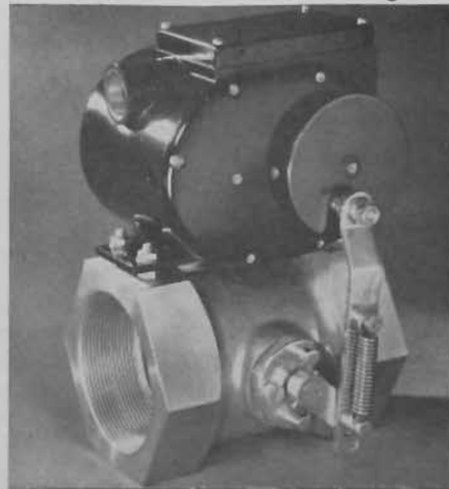
Radiators.—With a L.P.H.W. system being supplied from a boiler at constant temperature then a mixing valve, Fig. 3, controlled from an anticipatory control will give excellent results. A mixing valve is device which allows return water to be recirculated through the heating system either wholly or in such proportion with boiler water as to give a varying water temperature in the system.

Radiators, too, lend themselves to independent control either by individual valve and thermostat or, more often, zoning by valve and thermostat control.

Variation in water temperatures can be large when anticipatory controls are used, thus allowing maximum fuel economy.

Convectors.—In general the lower limit of water temperatures which can

continued overleaf



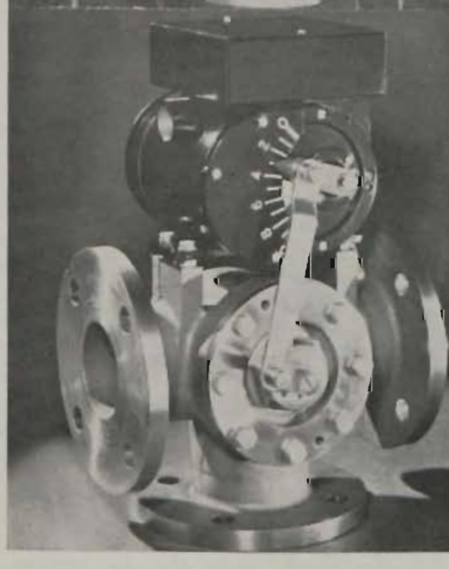


Fig. 1. On/Off Valve for L.P.H.W. Heating.
Fig. 2. Weather Sensitive Component for Anticipatory Control.
Fig. 3. Three Port Mixing Valve for L.P.H.W. Heating.

from page Nine

Automatic heat control

be allowed to flow through convectors is much higher than that for radiators —so that when an anticipatory control is used its range of depression should be smaller than that for a radiator system.

When forced draught convectors are used it is common practice to use a space thermostat to switch the fan or fans direct. On large installations an immersion thermostat can be fitted in the return main to switch the fans on only when the temperature has risen, thus preventing cold draughts when starting the system.

Unit Heaters.—Normally controlled by switching the fan from a space thermostat. Alternatively the steam or water main can be controlled by a motorised valve which is interlocked to switch off the fan when the valve is closed.

Heated Ceilings.—Overall control by an anticipatory control with local space thermostats and valves to allow for incidental heat gains in the space.

Embedded Panels.—These are supplied with water at reduced temperatures, usually about 120°F. Where the main source of heat is at high temperature (180°F.), it is not recommended that a mixing valve is used to obtain a permanent reduction in temperature. A better method is to use a fixed bypass system with a two-part modulating valve to bleed in high temperature water as necessary. Apart from the temperature reduction control it is not always essential to fit further controls except as safety devices. The lag in reaction of an embedded panel to alterations in water temperature is so great that a control operating on space temperature variations cannot be effective. Furthermore, since these panels operate at surface temperatures nearer to ambient temperatures, they are virtually self regulating in temperature if a mixing system is installed.

Radiant Panels.—No space temperature controller is wholly effective for this purpose and an anticipatory control will probably give better results.

As the reader will note, the subject has been dealt with only in very broad outline and once again it is strongly recommended that full use be made of the control manufacturers advisory services.

from page Six

Single stack plumbing

straight run below the highest fitment, and be of $3\frac{1}{2}$-inch diameter for two-storey dwellings, 4-inch up to five floors.

2. The wastes from bath, basin and sink must be connected separately to the vertical stack. This is very important.
3. All traps under 3-inch diameter must have a seal of 3-ins., and traps about 3-ins. diameter, such as W.C.'s, a 2-inch seal. P traps to be used wherever possible, especially on sinks. If S traps are used on basins, the horizontal run should be of $1\frac{1}{2}$-in. pipe.
4. The wastes from bath, basin and sink must have a fall of between $1\frac{1}{4}°$ and 5°, that is from $\frac{1}{4}$-in. per ft. to 1-in. per ft.

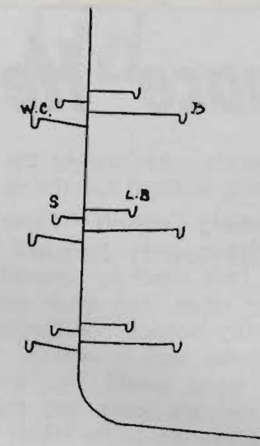
In practice, this works out at about 1 in 12 for wastes up to 2ft. 3in. long, 1 in 24 for pipes up to 4ft., and 1 in 48 for wastes up to 7ft. 6in. long. This is the permitted maximum length.

W.C. connections should be swept in the direction of the flow at the standard fall of 104° and branches up to 5ft. in length have been used successfully.

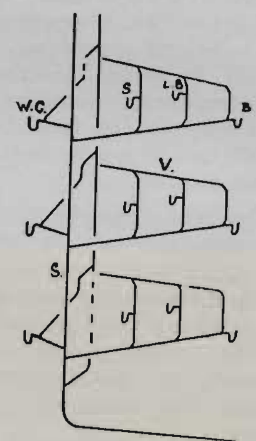
5. The length of the basin waste should not exceed 6ft. and the bath and sink to a maximum of 7ft. 6ins.
6. The distance between the centre of the lowest branch to the stack and the invert of the drain must not be less than 2ft. 6ins.
7. The bend at the base of the stack should be of large radius or, preferably, two 135° bends.
8. The waste connections to the stack should, preferably, be above the W.C. connection, but where these connections are below the W.C. branch, as may happen with bath wastes, they must be at least 8-ins. below the centre line of the W.C. branch inlet.

In conclusion, it is evident that the success of the system depends to a great extent on accurate pipe gradients and the use of deep seal traps. Our old tradition of giving a "good fall" to the waste pipe no longer holds good in this case. On the contrary, it's the worst thing a craftsman could do.

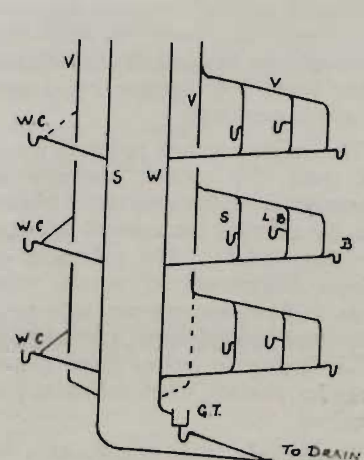
Scientific research has certainly changed our ideas in this field, and a spirit level is now as important as the two-foot rule to the plumber!



SINGLE STACK SYSTEM



ONE PIPE SYSTEM



TWO PIPE SYSTEM

from page eight

A. L. TOWNSEND ON WATER

The force of this expansion is considerable, exerting great pressures on internal surfaces of pipes, which frequently burst under the strain. This stoppage of water supplies is not only irritating, it could prove dangerous, especially if the hot water supply system were dependent on it.

Specific Gravity

Pure water is the standard substance with which the weight and volume of all substances are compared when one wishes to determine their Specific Gravity. Specific Gravity may be defined as the ratio of the weight of a given volume of any substance to the weight of the same volume of water. Hence the standard, water, is given a Specific Gravity figure of 1. Substances lighter than water, that is, those that will float, have a lower Specific Gravity than 1, and those heavier than water, that sink, have a greater Specific Gravity. These figures not only make it possible to compare the weight of a substance with water, they also make it possible to compare the weights of substances with each other.

Water Pressure

Water pressure is naturally caused by the weight of water which, under the influence of the earth's gravitational force, exerts pressure on all surfaces on which it bears. This fact is extremely important to the plumber, but before discussing it further it is necessary to consider the structure of water. All substances, whether solid, liquid or gas, are composed of infinitely small, separate particles of matter called molecules, which are held together by a force called cohesion (pulling together). In liquids the force of cohesion is very weak. This fact means that water molecules can move with relative freedom. The force of gravity tends to pull them all to the lowest possible position in the water, and since no single molecule likes to be left out, they all try to reach the bottom spot. Clearly this is not possible, but at least they can, as it were, level out in horizontal layers, and as a result the **free surface of a liquid at rest is horizontal,** i.e., parallel to the earth's surface.

Finds its own level

THUS water "flows" to find its own level in irregular-shaped containers—for example, the cisterns and pipework of hot water systems.

Diagram (A) shows what would happen to a pyramid of ball bearings. Gravity would make the upper balls fall until they were all in level layers, pressing down upon each other in the dish. If we took away the sides of the dish, the upper layers would spill outwards to form a single layer of ball bearings. From this we can see that the balls exert a **sideways** as well as a **downwards** pressure, as shown in diagram (B).

Diagram (C) extends this idea. Ball bearings poured into pipe (a) will roll or flow along the connecting pipe and rise up in pipe (b). Balls in the connecting pipe press downwards, sideways and upwards on the pipe in an attempt to reach the same level in (a) and (b).

See pages Twenty-six and Twenty-seven for illustrations

Imagine that these ball bearings are gigantic water molecules and you have a rough mental picture of the fluidity and pressure forces in water.

If a can two feet deep is filled with ball bearings they will press downwards at right angles to the bottom of the can and outwards at right angles to its sides. The pressure on the base of the can is caused by and equal to the weight of all the balls. The pressure on the side of the can at the base is also equal to the weight of all the balls. **But** half-way up the can the outward pressures are equal to the weight of only half the balls—that is, those above this half-way point.

It will also be clear that if the can had been only half filled, or, in other words, if the "column" of balls had been only one foot high instead of two, then the weight, and therefore the pressure at the base of the "column" or jar, would have been just half.

Finally, imagine the ball bearings arranged in neat columns or vertical rows up and down the can, as in dia-

Continued page Twenty-six

SAFETY FIRST

Beware Of Fragile Roof Coverings

FRAGILE ROOF COVERINGS can seem deceptively safe. They are liable to give way suddenly under the weight of a person standing or walking on them with serious and often fatal results.

Crawling boards which can be attached to the ridge of the roof must always be used for large jobs on or over fragile roof coverings. Ladders suitably secured and arranged to give a good toe-hold can be used for smaller repair jobs.

* * *

FALLING MATERIALS AND TOOLS cause many accidents in building, and it is essential that one should take care when placing materials or tools anywhere, whether overhead or on ground level. Plumbing tools, such as pipe wrenches and hammers, pipe fittings and tins of jointing compound, must never be left just balancing on a pipe or ledge.

* * *

BUILDING RUBBLE often causes accidents because people can easily trip over it.

Rubbish should be cleared as it arises so as to keep working spaces clear and safe.

Nails left sticking through timber should be pulled out or knocked flat. It is not the funniest thing in the world to have a nail pass right through one's foot.

* * *

PROTECTIVE CLOTHING helps to reduce accident risk.

Avoid loose clothing, especially neckties, which might get caught in tools or machinery. And "suede shoes with pink laces" may be fine for the odd night out with the lads, but good safety-sense demands stout boots or shoes for building work.

EYE PROTECTION.—One instinctively "ducks" when danger threatens. This is the natural reaction to seeing the danger and judging how near the body is to it. We cannot see our own eyes, and are apt to be more careless of their safety. It is wise to wear clear, unsplinterable goggles when working on a job such as cutting away brick or concrete where a chip could easily fly into, and damage, the eyes.

Oxy-Acetylene welding must not be carried out or watched without specially tinted goggles to protect the eyes against glare.

Electric arc welding also produces an intensely bright light, which can be very damaging to the eyes if viewed without dark protective screens. Even the reflected light of arc welding can be irritating to the eyes, so that here again goggles should be worn.

Success story from a tiny forge

SITUATED in the eastern corner of Co. Cavan, two miles from Bailieboro, is a compact group of enterprising factories which have stemmed from a tiny forge founded by a hardworking local man, John Corrie, away back in 1840.

Housed in an area of not much more than a couple of acres, one would imagine that the undertaking is a single unit, but, although much of the driving force and the directorship is common to all factories, they are, in fact, three distinct companies.

IRISH FOUNDRIES LIMITED.—Perhaps the most advanced and lucrative of the trio is Irish Foundries Ltd., which manufactures baths and fires for both the home and export markets, while they have recently branched out into a now field, producing Calipso Cabinet Cookers. This concern was founded only eleven years ago by Willie and Tom Corrie, grandsons of John Corrie.

Wide range

In addition to the Knight Convector, they are now turning out a wide range of Basket or Low fires as well as their patent " Kleanair " and " Leitar "—under floor convector units which are the only ones of their kind to be produced in Ireland.

J. CORRIE & CO. LTD.—The most direct successor to the original forge is J. Corrie & Co., which has kept in step with the times by manufacturing Tractool tractor and general farm implements without forsaking the horse-drawn appliances which are fading into antiquity day by day.

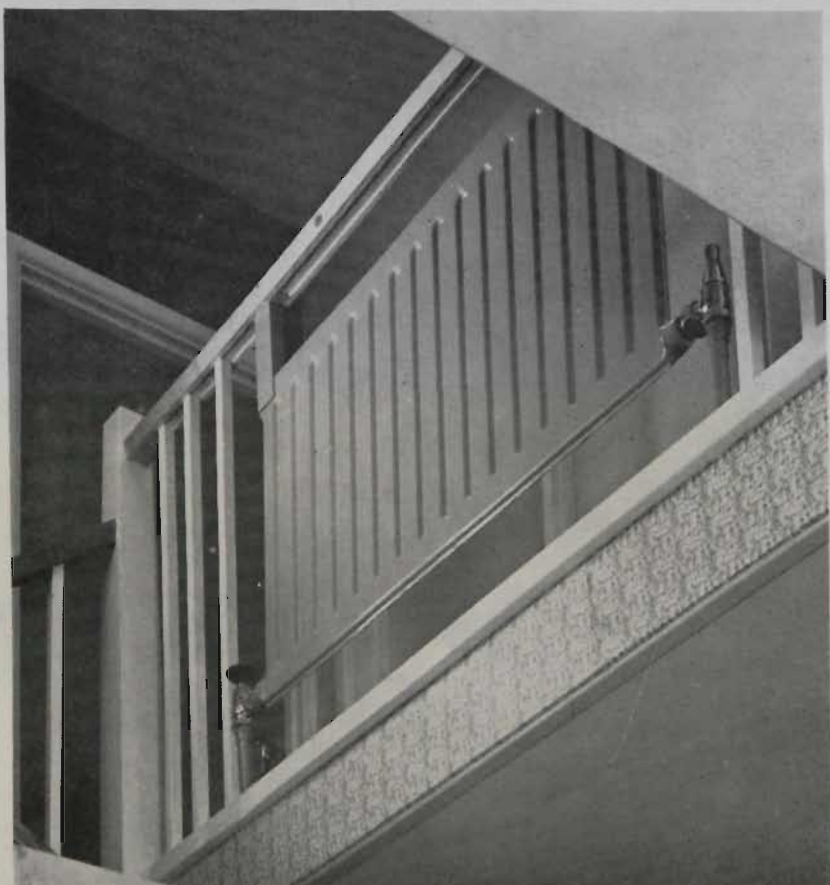
Assisted by the designing skill of the youthful but talented Manus Coffee ,the factory now produces an expensive variety of appliances such as buck-rakes, cocklifters, crop sprayers, disc harrows and fertiliser distributors, amongst many others for the Tractool range, which are marketed by Machinery Distributors Ltd., in Lucan, Co. Dublin.

CORRIE BOLTS LTD.—Corrie Bolts Ltd., which came into being in 1948, again through the hands of Messrs. W. S. and T. H. Corrie, is the most compact of the close working trio.

Ultra modern

Equipped with ultra modern machinery, the firm confines its activity to the production of a wide variety of engineering nuts and bolts and has supply contracts with the leading wholesalers throughout the Republic. In addition to this, the company also has a substantial demand from both of the other concerns in the group.

DOUBLE DUTY RADIATOR



WHERE to put a radiator in the confined space of a modern stairway can be a headache, and this picture shows an unusual way of solving the problem.

A slim Hurseal radiator has been built into the banisters, blending with the design of the staircase and at the same time being ideally placed to circulate warm air throughout the landing. In this case the radiator has been painted to match the remaining banister rails, but it might also be finished to match a contrasting wall or door. No special fixings are needed to install a radiator in this way.

The radiator shown is in 17 sections with a heating surface of 15.6 square feet. Larger or smaller radiators could equally well be installed in this way, to fit into the design of different staircases.

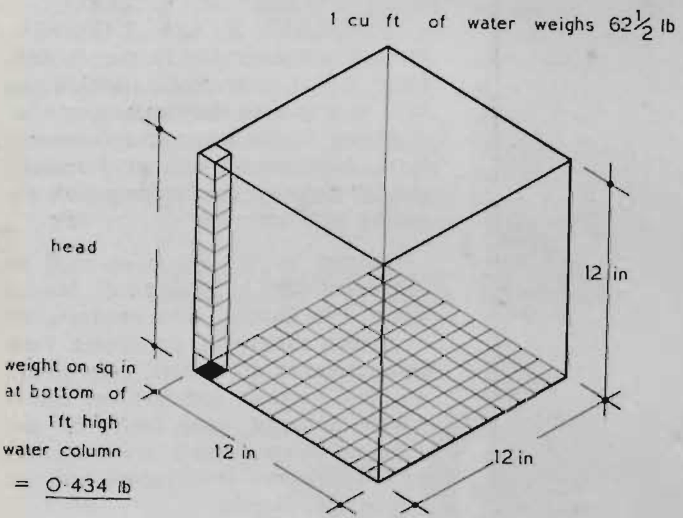
water

from page Twenty-three.

grams (B) and (C). We should have many such columns, and the **total pressure** on the base of the jar would be equal to the weight of all the columns added together. But the pressure at the base of **one row or column** of balls would be caused by the weight of only that one column.

Intensity of pressure is defined as pressure caused by the weight of water acting on one unit of area (usually a square inch).

Total pressure is the intensity of pressure on one unit area multiplied by the number of unit areas that the pressure acts or bears upon.



Specifically with water

NOW let us deal more specifically with water and the way in which its pressures are determined, measured and applied to plumbing work. My diagram shows that the weight of one cubic foot of water is 62.5 lbs. Therefore the total pressure on its base of 1 square foot is 62.5lbs. per square foot.

The total pressure is made up of 144 columns, each 1 foot high and 1 square inch in cross section.

Then Intensity of Pressure on the square inch base of each column.

= 62.5lbs. per square foot.
―――――――――――
144 square inches.

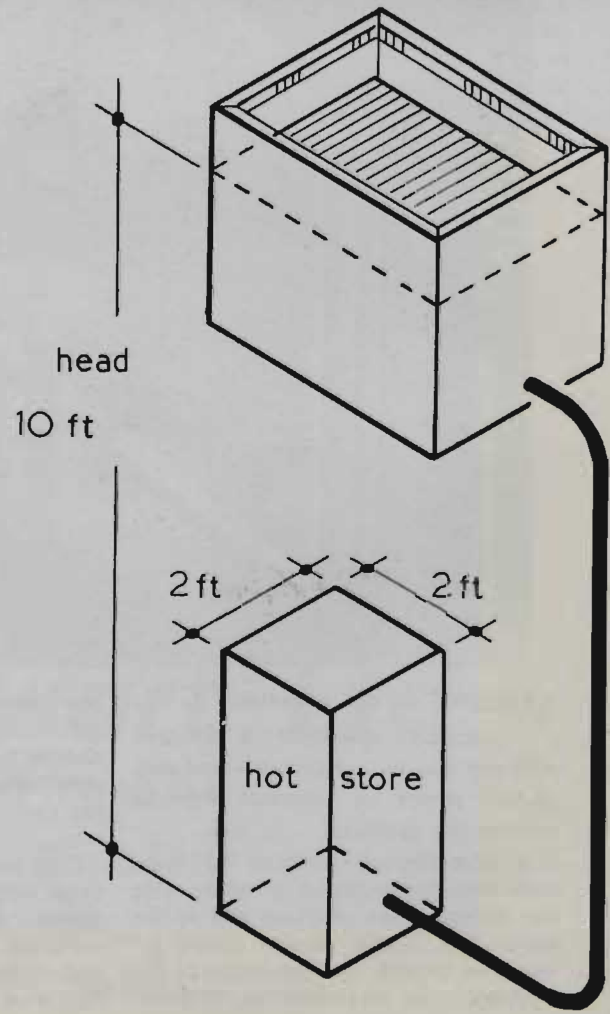
or **0.434lbs. per square inch.**

The meaning of the expression **pounds per square inch;** the statement **intensity of pressure is 0.434lbs. per square inch for each foot; "head" or vertical height of water column;** and the difference between **intensity of pressure** and **total pressure** should now be clear.

Another point to remember is that if the "head" is increased or decreased, the pressure is increased or decreased in proportion.

The application of this knowledge to plumbing work is illustrated in the simple example below:

Intensity of Pressure on base of hot store tank = ft. head × 0.434lbs. per square inch
= 10 ft. × 0.434lbs. per sq. inch.
Therefore Intensity of Pressure = 4.34lbs. per square inch.



https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q

Since **Total Pressure** = Intensity of Pressure per unit area × area acted upon (in some units), then **Total Pressure on base of hot store tank**

= Intensity of Pressure (lbs. per sq. inch × area in square inches)

= 4.34lbs. per square inches x 2' x 12" x 2' x 12" (area of base of tank in square inches)

= **2499.8lbs.** (note **not** lbs. per sq. inch).

AND:—

Intensity of Pressure on bottom of feed cistern

= Feet Head x 0.434lbs./sq. inch

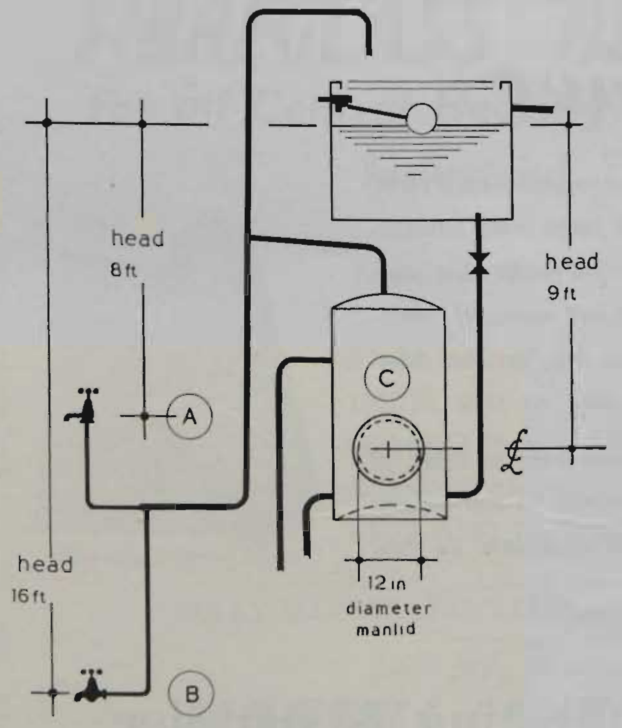
= 2 feet x 0.434lbs./sq. inch

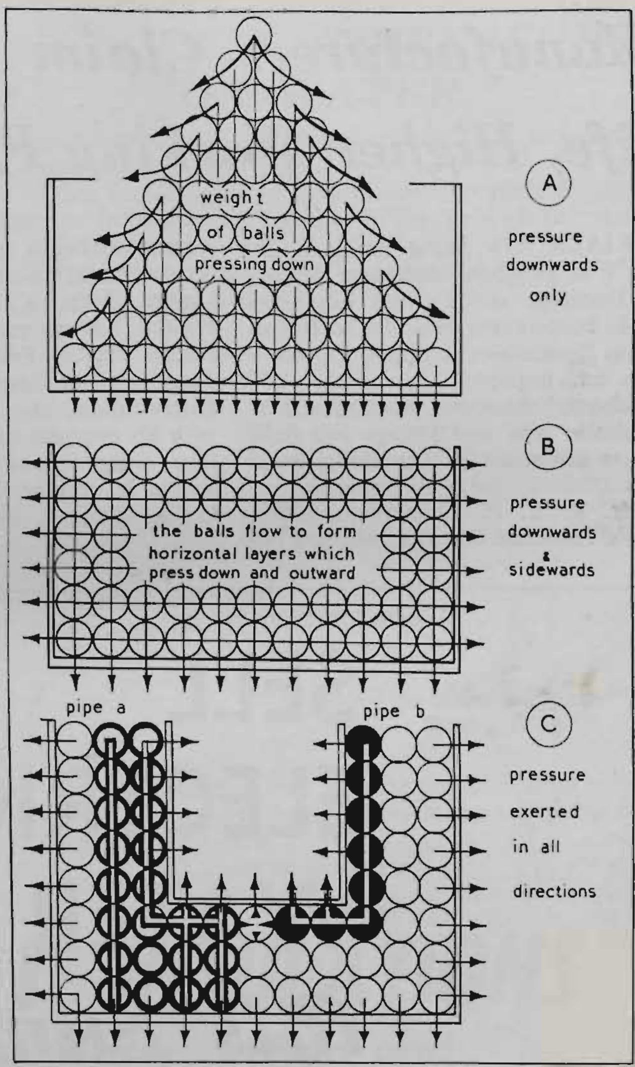
= **0.834lbs.**/sq. inch.

Note—The "Head" on the bottom of the feed cistern is 1/5th of the "Head" on the base of the hot store tank. Therefore the Intensity of Pressure acting on the bottom of the feed cistern is 1/5th that acting on the base of the hot store. Consequently the total pressure on the bottom of the feed cistern will be 1/5th of that which is tending to push the base out of the hot store tank.

Example ii.

Find i. Intensity of pressure at tap "A";
ii. Intensity of pressure at tap "B";
iii. Total pressure tending to push manlid "C" off the hot store cylinder.





● *see earlier text.*

Solutions.

i. Intensity of pressure at tap "A"

= Feet Head × 0.434lbs./sq. inch

= 8 feet × 0.434lbs./sq. inch

= 3.472lbs./sq. inch

(say) 3.5lbs./sq. inch

ii. Intensity of pressure at tap "B"

= Feet Head × 0.434lbs./sq. inch

= 16 feet × 0.434lbs./sq. inch

= 6.944lbs./sq. inch

(say) 7lbs./sq. inch.

Note—Increase in intensity of pressure is proportionate to vertical "head".

Horizontal lengths are ignored in calculating static pressures.

iii. Total pressure on manlid

= Intensity of Pressure (lbs./sq. in.) × area of circular manlid in inches.

Continued page Twenty-nine.

Manufacturers Claim Longer Life, Higher Working Pressures

TRIALS now being made at the West Drayton, Middlesex ,factory of Durapipe and Fittings Limited—stock holders in Ireland are British Steam Specialities Limited, Dublin—with an improved American ABS copolymer, show that the firm's thermoplastic pipe and fittings will have longer life and higher working pressures.

Mr. R. L. H. Damerham, Durapipe's Technical Director, who has just returned from a month's study tour of plastics manufacturing plants in the United States, is chairman of the Plastics Fittings sub-committee of the British Plastics Federation and U.K. delegate to the International Standards Organization, also renewed contact with his opposite numbers on the various organizations concerned with standards of pipe and fittings in the U.S.A.

● Mr. R. L. H. Damerham, Durapipe's Technical Director, who has just returned from a study tour of U.S. plastics manufacturing plants.

https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q

Intensity of pressure at horizontal centreline of manlid (by taking the "head" at the centre line of the manlid we get the average "head" acting on it)

= Feet Head × 0.434lbs./sq. inch
= 9 feet × 0.434lbs./sq. inch
= 3.906lbs./sq. inch

(say) 4lbs./sq. inch.

Then Total Pressure

= 4lbs./sq. inch x 3.142 x 0.5 x 0.5 x 144
= **452lbs.,** or just over 4 Cwts.

Note—Radius of manlid taken as 0.5 feet. Feet × feet = sq. feet. Sq. feet × 144 = sq. inches (same unit of area as Intensity of Pressure).

For a little more practice, measure the vertical distance from the water level in your cold feed cistern at home to the various taps in the house. Then work out the intensity of pressure at these points when the taps are closed and the water in the cistern is therefore static—that is, standing still.

Rules and conversions

A **WATER** column one foot high will exert a pressure of 0.434lbs. on each square inch of its base. The height of a water column which would exert just 1lb. per square inch pressure on its base can be shown to be 2.31 feet:—

One cubic foot of water weighs 62.5lbs. and contains 1,728 cubic inches. Therefore, one cubic inch of water, or a water column one inch high and with a base of one square inch, weighs 0.036lbs.

The height of a water column which will exert a pressure of 1lb. per square inch at its base is therefore 1lb. pressure divided by 0.036 (the pressure for one inch of

from page Twenty-seven.

A. L. TOWNSEND ON WATER

water column) and this works out at 27.77 inches water column, or 2.31 feet "Head".

This useful figure of 2.31 makes it possible for one to discover from a given pressure in lbs./sq. inch the number of feet head which cause it.

The following rules will be found helpful:—

i. Intensity of pressure
= Feet "head" of water × 0.434lbs./sq. inch.

ii. Total pressure
= Intensity of pressure × **total area** acted upon (same unit of area as for intensity of pressure, usually measured in square inches).

iii. Feet "head"
= Intensity of pressure in lbs./sq. inch × 2.31.

iv. Intensity of pressure
$$= \frac{\text{Feet "head"}}{2.31}$$
(Note—This is an alternative to Rule i).

Furthermore:

i. "Head of water is that **vertical** distance from the free surface of water in a storage vessel to any point under consideration below.

continued overleaf

Building Services News, Vol. 1, Iss. 2 [1961], Art. 1

from previous page.

ii. When water is still it is in what is known as a "static" condition, and the "head" might be referred to as the "static head".

ii. Water pressure is directly proportionate to its depth, or "static head".

iv. Water pressure is exerted on all surfaces upon which it bears, and it exists at right angles to those surfaces.

Example i.: An altitude gauge fitted on a central heating boiler indicates a "head" of water of 42 feet. What pressure is applied to the boiler as a result of this height of water column?

Ans.: Pressure in lbs./sq. inch

$$= \frac{\text{Feet "Head"}}{2.31} = \frac{42 \text{ Feet}}{2.31}$$

= 18.2lbs./sq. inch.

Example ii.: The pressure in a water main is 75lbs./sq. inch. Ignoring friction resistances, etc., to what height would this water rise in a vertical supply pipe?

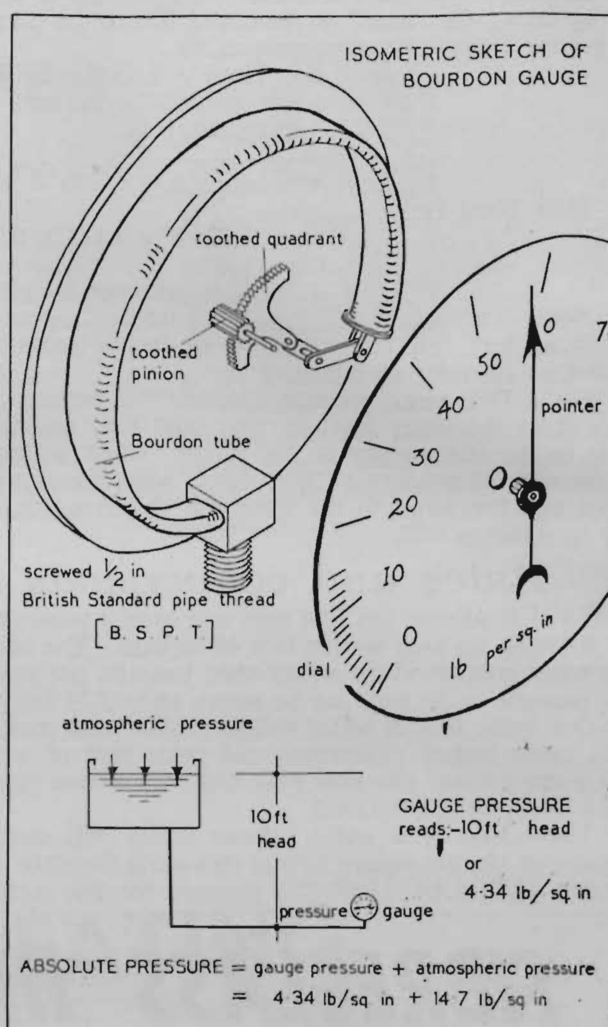
Ans.: Feet "Head"

= Pressure in lbs./sq. inch × 2.31
= 75lbs./sq. inch × 2.31
= 173.25 feet.

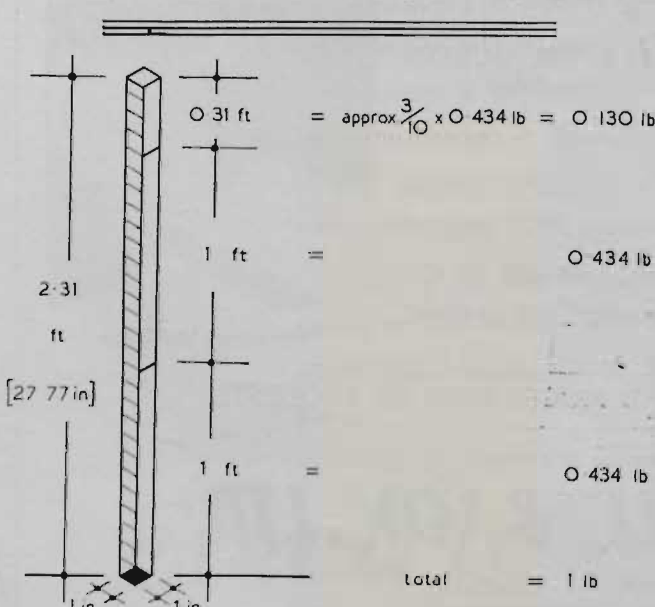
Measurement of water pressures

THE intensity of pressure in plumbing systems is measured on a Bourdon Gauge, a simple device containing a near circular loop of flattened phospher bronze tube. This tube—the Bourdon tube—tends to open out when pressure is applied to its inner surfaces. In doing so it pulls on a toothed quadrant which rotates a toothed pinion. This pinion spindle carries a pointer, which moves round a suitably divided scale on the dial of the gauge to indicate the pressure within the Bourdon tube, and hence the pressure within the system of pipework to which the gauge is attached.

The dial scale of the Bourdon pressure gauge is calibrated or divided off to register pounds per square inch (P.S.I. or lbs./sq. inch).



Pressure Measurement



A similar gauge with a scale divided to register "feet head" instead of lbs./sq inch would be called an altitude gauge. It would be used to indicate the head of water in a central heating system, so that if there were any loss of water from the system from evaporation or some other cause, and the cold feed ball valve failed to supply more water, the deficiency would be shown by loss of head on the gauge. (See example i.).

"Gauge Pressure" indicates the pressure in a system caused by the head of water. It should be noticed that the atmospheric air also has weight and exerts a pressure of some 14.7lbs./sq. inch on the free surface of water. However, pressure also acts on the outside of the system and so cancels itself out. Normally, therefore, one only refers to gauge pressure.

"Absolute Pressure" indicates the sum of the gauge pressure + the atmospheric pressure.

"Absolute Pressure" = Gauge Pressure + Atmospheric Pressure = 4.34lbs./sq inch + 14.7lbs./sq. inch = 19.04lbs./sq. inch.

In the given example:

= 4.34lbs./sq. inch + 14.7lb./sq. in.
= 19.04lbs./sq. inch.

https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q

A. L. Townsend* A.M.I.P., M.R.S.H., *discusses . . .

Some Properties Of Plumber's Metals

HERE is a list of the most important properties of matter which the plumber must consider when selecting his materials.

Specific Gravity denotes the weight of a substance in comparison to the weight of the same volume of water.

Specific Gravity figures, shown in Table A, make possible quick and easy comparisons between the weights of equal volumes of different metals, since the higher the Specific Gravity figure, the heavier is the metal. For example, the Specific Gravity of lead is 11.3, and that of aluminium is 2.7. This shows that lead is 11.3 times heavier than water, and aluminium is 2.7 times heavier than water. Therefore lead is over four times heavier than aluminium.

Fusibility, or melting point, denotes the temperature at which a metal changes from its solid state to a molten liquid.

It should be noted that cast-iron melts at a much lower temperature than mild steel, which is a purer form of iron. The lower fusibility of cast iron enables that metal to be easily melted and poured into casting moulds, and thus permits cast iron goods to be quickly and cheaply made. Mild steel has the highest melting point of all the plumber's metals. Although unyielding at normal temperatures, when heated to red heat it can be easily bent.

Malleability denotes the property of a metal which enables it to be "bossed" or worked to shape without breaking. Lead has this property to a remarkable degree, whereas ordinary cast iron is not malleable at all.

Malleable cast iron fittings used for mild steel pipework are specially treated with heat to make them less brittle than they would otherwise be. The malleability of these fittings is such that they may be squeezed flat in a vice without breaking and this could not be done with ordinary cast iron. However, this degree of malleability is useful more for the fact that it can relieve strain than for the working properties which we normally associate with malleability.

Thermal heat conductivity denotes ability to transmit heat from particle to particle throughout its mass or length.

All metals possess this property, though to different extents.

Electrical conductivity is a property possessed by all metals in varying degree.

Of the plumber's metals, copper is the best conductor of electric current. Aluminium is next best; it is about half as effective as copper for the purpose. Because of its lightness it is much used, suitably reinforced with a central steel core wire, for high voltage cables on the electric grid system.

Co-efficient of thermal expansion.—All metals expand when heated, and the effects of this must be carefully allowed for in work on roofs, and in work on hot water and central heating pipework systems.

Ductility denotes the property of stretchability, which enables a metal to be worked, and especially wires or tubes to be drawn, without breaking.

Annealed or softened copper and aluminium are very ductile. Lead is ductile to an extent; it can be stretched within limits. The stretching of lead or any other material reduces its thickness. In the case of leadwork the aim is always to leave the finished work of equal thickness throughout. Care must be taken, for this reason, not to rely on what ductility lead possesses to "stretch" it; it is better "bossed" into shape.

Tenacity denotes ability to resist pulling forces. As you may know, once a bulldog clamps his jaws on the seat of anyone's pants he resists all efforts to pull him off, and there is a well-known expression, "as tenacious as a bulldog."

The tensile strength of a material is a measure of its tenacity, and it is determined by clamping a short length of material—steel, copper or any

continued overleaf

TABLE A.
SOME PROPERTIES OF PLUMBER'S METALS.

Metal	Chemical Symbol	Specific Gravity	Density or Weight lb./cu.ft.	Melting Point of	Tensile Strength Tons/sq. in.	Conductivity taking Copper as 100 Electrical	Conductivity taking Copper as 100 Thermal (Heat)
Lead (Milled)	Pb	11.3	709	621	1.2	7.7	9
Copper	Cu	8.9	554	1981	14 to 26	100	100
Aluminium	Al	2.7	167	1220	6 to 10	62	58
Zinc	Zn	7.1	449	788	7 to 10	28	29
Tin	Sn	7.3	462	232	1	15	17
Cast Iron	Fe	7.2	450	2780	5 to 18	17	17
Wrought Iron	Fe	7.7	480	4000	20 to 27	do.	do.
Steels	Fe	7.8	488	3500	28 to 33	do.	do.
Mercury	Hg	13.6	850		liquid at normal temperatures.		

NOTE.—Properties vary according to condition, i.e., "cold" worked, "hot" worked; hard or annealed. The above figures are therefore approximate, especially with regard to Tensile Strength and Elasticity.

from previous page.

other—between the jaws of a tensile testing machine. The jaws are made to pull in opposite directions and then impose pulling stresses on the test piece, which stretches until it finally breaks.

The pull or force weight (in tons) at which the test piece breaks is a measure of its tensile strength. So that the tenacity of various metals can be compared, the tensile strength of each is fixed as the number of tons pull needed to break a bar of the metal one square inch in cross section.

Elasticity denotes the ability of a material to resume its normal shape after being pushed or pulled out of shape.

Work hardening denotes that a metal, though ductile in the normal or "soft" state, will become gradually harder as it is worked upon by tools, for example, in bossing processes, or in drawing processes used in wire or tube manufacture. Lead does not work harden to any noticeable extent. Copper and aluminium do, but can be restored to a soft, ductile state by annealing; that is, by heating the metal and then either cooling it in water or allowing it to cool in air.

Annealing is another way in which heat can effect the properties of metals, and it has practical applications in the working of sheet copper and aluminium, and the bending of tubes.

It is interesting to notice that ductility, tenacity or tensile strength, elasticity, and work hardening are all closely connected. As cold working on metals alters the shape of the crystals which make up the metal, so the property of ductility is lessened, but tenacity, elasticity, and hardness increase.

Creep denotes the tendency of materials to "flow" under the influence of a load. All metals tend to creep, and this occurs when there is a change in shape of the metal crystals; when, for example, a heavy load tends to squash them, or a strong pull to stretch them. Creep is tied up with tenacity, hardness, and ductility, and an increase in a metal's temperature will increase its tendency to creep.

It is necessary to be very careful when fixing sheet lead on steep slopes or vertical surfaces, since otherwise the weight of the lead will impose a tensile stress upon itself. A hot summer sun will heat the lead and make matters worse. If lead movement down the slope is not restrained by proper design and fixing support, it might be so stretched at its top fixings that it would become thin enough to tear.

The lighter weight and greater stiffness of copper and aluminium sheeting combine to make these more immune from these problems.

Colour is produced as a result of a surface reflecting certain lights. As a property of metals it is important because it is a means of identification; one can often recognise a metal by its colour without even picking it up to judge its weight or other properties. Copper, for example, is clearly recognisable because it is reddish brown, and therefore not easily confused with, for example, newly cut lead, which is silvery in colour.

Durability denotes the quality of lasting and is therefore very important. Metals are acted upon by the oxygen in the atmosphere which combines with the surface of most metals to form a "skin" of oxide which protects them against further attack. With iron and steel, however, the oxides crack and split, revealing fresh surfaces for attack beneath. In order for these metals to be durable, therefore, it is necessary to provide artificial protection in the form of, for example, paint or galvanising.

Metal solvency.—Water is a solvent; that is, it will dissolve substances. The dissolving of sugar in tea is a good example of this.

Metals tend to dissolve in water, some more than others, and in each case the dissolving rate or solvency of the metal will depend upon the chemical condition of the water.

Lead is poisonous, and lead piping must never be used in districts where waters show a tendency to dissolve metals. If it were, **plumbic solvency** might occur, with unpleasant results.

Copper and zinc are similarly acted upon by metal solvent waters, giving rise to **cupro-solvency** and **zinc-solvency**. In the case of copper the danger to health is not great, but it does sometimes cause green staining of baths and sinks. Zinc-solvency is not particularly harmful, but metal solvent waters will quickly dissolve the protective zinc galvanising from mild steel tubes, fittings and cisterns, to leave the underlying mild steel open to attack by rust. The effect of this will be water discoloured by the rust and a very short life for the mild steel pipes and cisterns.

● Our acknowledgments to The Hutchinson Group for the rights to compile our series by A. L. Townsend, M.R.P., M.R.S.H., from a work of his shortly to be published by Hutchinsons, and for the article appearing on this page.

NEXT MONTH

A. L. TOWNSEND on—
The Atmosphere (Composition of air; Properties of air; Atmospheric corrosion; and Protective coatings applied to metals).

* * *

R. E. AYERS on—
Automatic Temperature Control (Oil burner controls).

* * *

J. J. HAIG concludes his series on—
Small Bore Heating.

MONSELL AND MITCHELL OPEN DOMESTIC HEATING SHOWROOM

A new domestic heating showroom was opened earlier this month by Messrs. Monsell Mitchell & Co., Ltd., in association with Irish Shell Ltd., at 67-73 Townsend St., Dublin, by June Ganley, "Mrs. 1970," who was chosen in England to represent the "housewife of the future" in a campaign to make the advantages of central heating available to housewives generally.

She said that the appliances on show would help to bring about a fundamental change in the homes in which they were installed. Oil-fired central heating was a luxury that every family could enjoy.

Mr. E. K. O'Brien, General Manager, Monsell & Mitchell, introduced Mrs. Ganley.

● **Full report and pictures next month.**

Published by Irish Trade and Technical Publications, Callaghan Chambers, 13-15 Dame Street, Dublin; Printed by The Greyhound and Sporting Press Ltd., Davis Road, Clonmel.

https://arrow.tudublin.ie/bsn/vol1/iss2/1
DOI: 10.21427/D7CM5Q